

SYNOPSIS OF *GONOLOBUS* S.S. (APOCYNACEAE: ASCLEPIADOIDEAE)
IN TRINIDAD AND TOBAGO

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ABSTRACT

A synopsis of *Gonolobus* s.s. (Apocynaceae, Asclepiadoideae, Gonolobinae) in Trinidad and Tobago, including a key, descriptions, and illustrations, is provided to facilitate recognition and conservation of the two accepted species: *Gonolobus rostratus* and *G. tobagensis*. The misapplication of names both in the literature and to South American specimens is discussed.

RESUMEN

Se aporta una sinopsis de *Gonolobus* s.s. (Apocynaceae, Asclepiadoideae, Gonolobinae) en Trinidad y Tobago, que incluye una clave, descripciones, e ilustraciones, para facilitar el reconocimiento y conservación de dos especies aceptadas: *Gonolobus rostratus* y *G. tobagensis*. Se discute la mala aplicación de los nombres en la bibliografía y en los especímenes suramericanos.

About fifty species of subtribe Gonolobinae (Apocynaceae, Asclepiadoideae) occur on the islands comprised by the Greater and Lesser Antilles, the Bahamas, Trinidad and Tobago, and Aruba and the Netherland Antilles. Evidence from the chloroplast (Rapini et al. 2003; Liede-Schumann et al. 2005; Rapini et al. 2006; Krings et al. 2008) and nuclear genomes (Krings et al. 2008) supports the monophyly of the subtribe, as well as of *Gonolobus* s.s. Krings (2008a) recently provided a revision of *Gonolobus* s.s. in the West Indies. However, Trinidad and Tobago were excluded from that treatment due their South American affinity. The objective of this note is to provide a key to and descriptions of the species of *Gonolobus* s.s. from Trinidad and Tobago to facilitate their recognition and conservation.

This treatment is derived from a larger critical study of ca. 250 specimens of the fifty some known species in West Indian Gonolobinae, obtained in part through: (1) loan requests from ninety herbaria—of which sixty-five responded with either loans, digital images, or negative search results (see Acknowledgements), (2) visits to BM, BSC, DUKE, HAC, HAJB, IJ, K, UCWI, UPRRP, US, and P, and (3) forty-eight days of field work by the author in the Bahamas (Long Island), Cuba, Dominica, Jamaica, Puerto Rico, St. Lucia, and St. Vincent. The treatment is also informed by analyses of sequences of portions of the chloroplast (*trnL-F*, *rps16*) and nuclear genomes (*LEAFY*) of selected accessions (see Krings et al. 2008).

TAXONOMIC TREATMENT

Two species of *Gonolobus* s.s. are recognized from Trinidad and Tobago. Descriptions of the species are provided following a key to the species. Corona morphological terminology follows Liede and Kunze (1993) and Kunze (1995): Ca = faucal annulus (corolline corolla); Cd = dorsal anther appendage; Ci = interstaminal gynostegial corona; C(is) = fused staminal and interstaminal gynostegial corona; Cs = staminal gynostegial corona. Species are arranged alphabetically. Following Franz et al. (2008), taxon concept mapping is provided to facilitate databasing. The operator = is used to indicate whether a given taxon concept is equal to a previously published concept. The symbol ≠ is used to indicate the misapplication of a name to a concept.

KEY TO *GONOLOBUS* S.S. IN TRINIDAD AND TOBAGO

1. Calyx lobes ovate, 4.1–8.4 mm × 1.9–5.5 mm, apices obtuse to rounded; corolla lobes glabrous adaxially _____ **1. *G. rostratus***
1. Calyx lobes linear-lanceolate, 8.5–13 mm × 1.7–2.6 mm, apices acute to narrowly obtuse; corolla lobes pubescent adaxially _____ **2. *G. tobagensis***

1. *Gonolobus rostratus* (Vahl) Schult. in Roemer & Schultes, Syst. Veg. 6:61. 1820. (**Fig. 1**). *Cynanchum rostratum* Vahl, Symb. Bot. 3:45. 1794. TYPE: TRINIDAD: (von Rohr?) Hb. Liebmann (HOLOTYPE: C [IDC microfiche photo: Vahl herbarium nr. 17: III, 5!]; ISOTYPE: BM!).

Gonolobus broadwayae Schltr. in Urban, Symb. Antill. 7(3):340. 1912. TYPE: TRINIDAD: Lopez 2419 (LECTOTYPE, designated by Krings 2008b: Z!)

Herbaceous perennial vines. Latex unknown, presumably white. Stems pubescent, both short, capitate-glandular, and longer, sharp, eglandular trichomes present, the latter throughout, spreading, or retrorse internodally, and antrorse-appressed along an indistinct, horizontal ridge between two opposing petioles and/or just above the node, to 1.07 mm long; nodes pubescent, gland field apparently absent. Leaf blades ovate to oblong-ovate, 1.9–10.2 cm × 0.9–6.6 cm, apices gradually acuminate with the acumen narrowly obtuse, to 1.2 cm long, bases deeply cordate, margins entire, evenly strigillose on both surfaces, trichomes sharp, eglandular, to 1 mm long, glandular emergences from the surface apparently absent, colleters 2–3, 0.9–1 mm long; petioles 0.9–6.8 cm long, pubescent on all sides, capitate trichomes to 0.16 mm long, sharp, eglandular trichomes antrorsely-ascending or -appressed, ca. 0.7 mm long; stipular colleters 2, ca. 0.3 mm long, one borne on each side of the petiole base (rarely on the stem), ca. 0.3 mm long. Inflorescences racemiform, peduncles 0.4–2.2 cm long, capitate, as well as sharp, eglandular trichomes present, the latter mostly antrorsely-appressed or -ascending, distributed throughout, ca. 0.4 mm long; pedicels 1.2–4 cm long, evenly pubescent from apex to base, capitate-glandular trichomes ca 0.1 mm long, longer, sharp, eglandular trichomes antrorsely-ascending, ca. 0.8 mm long, bracts linear-lanceolate, ca. 5.1–5.5 mm × 0.8–1.1 mm long, caducous, adaxial surface glabrous, abaxial surface coarsely pubescent, trichomes sharp, eglandular, 0.38–0.4 mm long, antrorse. Calyx lobes 5, ovate, 4.1–8.4 mm × 1.9–5.5 mm, apices obtuse to rounded, margins sparsely glabrous or ciliate, abaxial surface sparsely pubescent at the base and glabrous toward the apex, trichomes antrorsely appressed or -ascending, to 0.3 mm long; colleters 1 per sinus. Corolla lobes 5, linear-lanceolate or lanceolate, 12–22 mm × 4.3–6.7 mm, slightly lobed at the base, a glandular swelling frequently present in the sinus, adaxial surface glabrous, abaxial surface sparsely pubescent with coarse, sharp, eglandular, antrorsely-appressed or -ascending trichomes, trichomes ca. 0.25 mm long; faucal annulus (corolline corona or Ca) interrupted, a raised bump or indistinct ridge opposite each corolla lobe sinus, pubescent or glabrous; gynostegial corona of fused staminal (Cs) and interstaminal (Ci) parts, prostrate-undulating, single, secondary nectaries in interstaminal position absent or at least not formed into distinct bumps or mounds; anther guiderails without appendages, laminar dorsal anther appendages (Cd) 1.3–1.5 mm wide, truncate to rounded; style-head ca. 5.4 mm diam, stipe ≤ 0.8 mm long, edentate. Pollinaria: corpuscula ca. 0.23 mm long, pollinia borne horizontally, narrowly ovate, ca. 1.1 mm × 0.4 mm. Follicles apparently known only from a photo taken by P. and Y.S. Comeau, but this was not obtained on loan.

Phenology.—Flowering in March, April, May. Fruiting in March.

Distribution and habitat.—In the Caribbean region, *G. rostratus* is known only from Trinidad, where it has been found on road banks. Its distribution in South America needs to be re-examined (see discussion below).

Etymology.—The specific epithet means “beaked.”

Taxon concept mapping.—≠ *G. rostratus* sensu Schlechter (1899); = *G. broadwayae* sensu Schlechter (1912); = *G. broadwayi* sensu Cheesman (1947).

Notes.—Schlechter (1899) mistakenly listed “*Gonolobus rostratus* Griseb. Flor. (‘1861’[1864]) p. 420 (nec R.Br.)” in synonymy with *G. ciliatus* Schltr. The lectotype of the latter, i.e., Eggers 5561 (P!; designated by Krings 2008b), is referable to “*Matelea*” *denticulata* (Vahl) Fontella & E.A. Schwarz (≡ *Gonolobus denticulatus* (Vahl) W.D. Stevens, if accepting *Gonolobus* sensu lato; holotype: von Rohr120, C [IDC microfiche photo: Vahl herbarium nr. 17: III, 1!]; Krings 2008b). For two reasons it seems clear that Grisebach (1864) did in fact mean *G. rostratus* as based on *Cynanchum rostratum* Vahl, rather than “*Matelea*” *denticulata*, when he penned his description. First, he noted the corolla lobes of “his” *G. rostratus* to be lanceolate-linear. Corolla lobes of

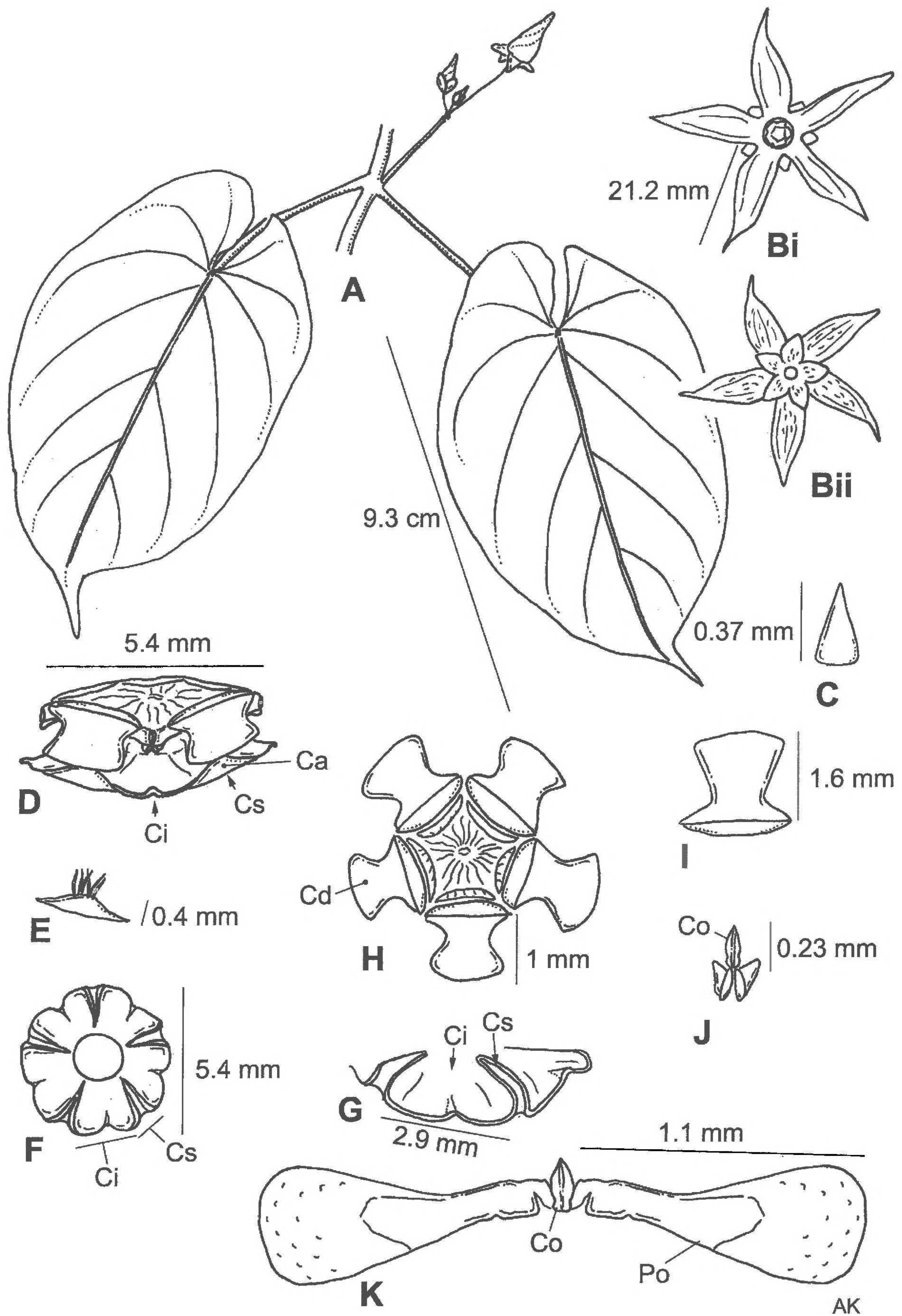


FIG. 1. *Gonolobus rostratus*. A. Leaves and inflorescence. Bi. Open flower (adaxial view). Bii. Open flower (abaxial view). C. Calycine colleter. D. Faucal annulus of the corolla, gynostegial corona, and style-head. E. Detail of faucal annulus. F. Gynostegial corona of fused staminal (Cs) and interstaminal (Ci) segments (style-head removed). G. Side view of gynostegial corona. H. Style-head and laminar dorsal anther appendages (viewed from above). I. Laminar dorsal anther appendage. J. Corpusculum and subtending anther wings. K. Pollinarium. A, C–K based on *Britton & Hazen 1601* (GH). Bi–ii based on *Fendler 637* (E). Ca = faucal annulus of corolla; Ci = interstaminal gynostegial corona segment; Cd = laminar dorsal anther appendage; Co = corpusculum; Cs = staminal gynostegial corona segment; Po = pollinium.

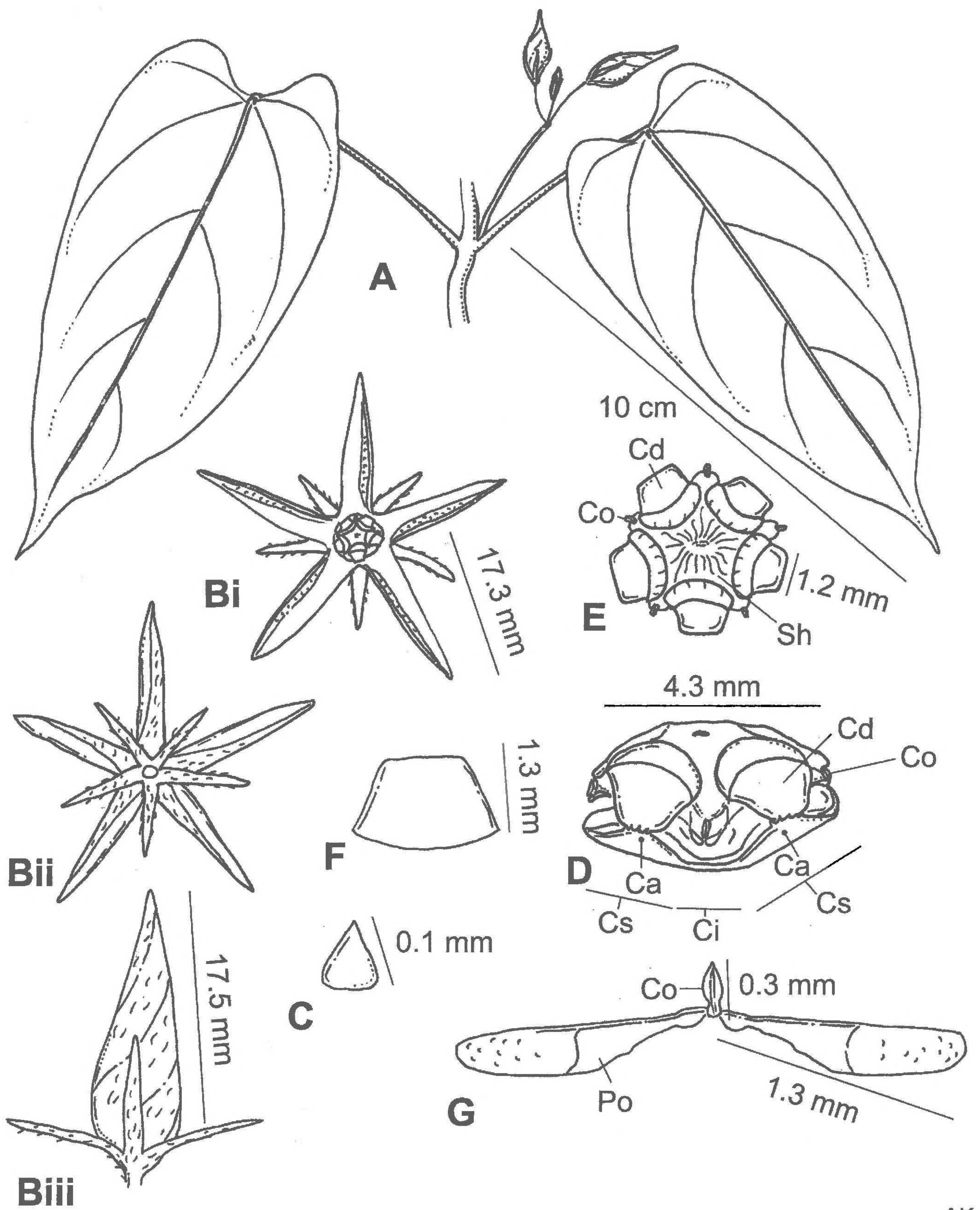
“*Matelea*” *denticulata* are broadly elliptic to ovate, whereas those of *G. rostratus* are linear-lanceolate to lanceolate. Second, Grisebach (1864) cited a plate (i.e., t. 7) in Vahl’s *Icones illustrationi plantarum Americanarum* (1798), which is so strikingly similar to the holotype of *C. rostratum* at C, as to leave little doubt that it must have been based on it. The ovate calyx lobes of the mature flower are clearly visible in the illustration. A contrasting illustration of *C. denticulatum* (basonym of “*M.*” *denticulata*) is found on plate 8 of the *Icones* (Vahl 1798).

Perhaps following Schlechter (1899), Cheesman (1947) also mistakenly considered “*Gonolobus rostratus* R.Br. sens. Griseb Fl. 420” synonymous with the entity today known as “*Matelea*” *denticulata*, by submerging the former name under a synonym of the latter: *Matelea viridiflora* (G.F.W. Meyer) Woods. Based on Cheesman’s description (e.g., “cal[yx] lobes lanceolate,” “corolla [...] lobes ovate,” “anthers without dorsal appendages”), his concept of *Matelea viridiflora* (G.F.W. Meyer) Woods undoubtedly corresponds to “*M.*” *denticulata* and not *Gonolobus rostratus* sensu Grisebach (1864) and (Vahl) Schult. as discussed above.

The confusion regarding the application of names appears to extend beyond the Caribbean region and affects our understanding of the ranges of *G. rostratus*, *G. tobagensis*, and potentially other species. Fontella & Schwarz (1981) proposed that the following names (and combinations based on them) be added to the synonymy of *G. rostratus*: *Cynanchum rotatum* Vell. (lectotype: Fl. Flum. Icones t. 79!, designated by Fontella & Schwarz 1981), *Gonolobus patens* Decne. (holotype: *Martius s.n.*, M, n.v. [apparently seen by Fontella and Schwarz, but not relocated by M in searches in Fall 2008]), and *G. oxyanthus* Turcz. (holotype: *Funck 2*, G!, P!). As a consequence of this decision, the name *G. rostratus*, has now been applied widely to plants from Tobago to Brazil, Peru, and Argentina (e.g., Fontella & Schwarz 1981; Morellato & Leitão-Filho 1999; Hechem & Ezcurra 2006). Plants from West Africa—considered recent introductions (D. Goyder, pers. comm.)—have been referred to *G. rostratus*, as well. However, based on a preliminary survey of specimen images available to me, including three African collections, it appears that *G. rostratus* may exhibit a much narrower range than presently considered, if not be endemic to Trinidad. The majority¹ of northern South American and African material available to me bearing the name *G. rostratus*, *G. patens*, or *G. oxyanthus* exhibits calyx lobes with acute to acuminate apices, whether linear-lanceolate or ovate, rather than with obtuse to rounded apices as in *G. rostratus* (e.g., Argentina: *Cabrera et al.* 32105, SI; Argentina: *Vanni et al.* 83, K; Argentina: *Venturi* 9677, K, SI; Bolivia: *Wood & Goyder* 16744, K; Ghana: *Merello et al.* 1662, K; Ivory Coast: *Fosberg* 40488, US; Paraguay: *Hassler* 227, SI; Venezuela: *Aristeguieta* 6505, US; Venezuela: *Funck 2*, G, P; Venezuela: *Pittier* 11787, US). In general appearance this material seems much closer to *G. tobagensis*, although I am not convinced that the latter is the correct name nor that a single taxon is represented. Based on the protologue, *Gonolobus patens*, for instance, also exhibits similar linear-lanceolate to lanceolate calyx lobes (Decaisne 1844). The holotype of *G. patens* (Brazil, *Martius s.n.*) resided at M according to Decaisne’s (1844) account, but was not recently relocated (F. Schuhwerk, pers. comm.). Fournier (1885) apparently saw this specimen—or at least cited it. He described the calyx lobes of this species as ovate and provided an illustration (t. 94) depicting calyx lobes ovate to lanceolate, but with acute apices, not obtuse as in *G. rostratus* (Fournier 1885). Neither Decaisne (1844) nor Fournier (1885) recognized *G. rostratus* from Brazil. Fontella and Schwarz (1981) were apparently the first to associate *G. patens* and *G. rotatus* with *G. rostratus*. Unfortunately, a complete survey of South American and African entities to which the name *G. rostratus* has been applied is beyond the scope of the present study and limited by the lack of availability of the type of *G. patens*. It appears that either *G. rostratus* displays considerable morphological heterogeneity or that multiple taxa are represented. It is hoped that the key and descriptions provided here will contribute to this much needed survey.

Additional specimens examined: Hab. in Ins. Carib., *Anonymous s.n.* (L). **Trinidad.** Apr [18?]74, O. Kuntze 881 (E); Morne Cocoa Road, bank, 9 Apr 1920, N.L. Britton and T.E. Hazen 1601 (GH, K); Gaura Old Rd., 19 May 1937, Cheesman 13168 (TRIN); 1877–80, A. Fendler 637 (BM, E); Heights of Aripo Rd., close to small ravine or close to Rhapsy’s Estate, Mar 1987, F. Moreau s.n. (TRIN); Mar [18?]85, H. Prestoe s.n. (K).

¹One specimen from Peru, *Quipuscoa* 378 (K!), has been referred to *G. patens* but departs from the typical form in bearing very long (1cm+) ovate sepals.



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FIG. 2. *Gonolobus tobagensis*. A. Leaves and inflorescence. Bi. Open flower (adaxial view). Bii. Open flower (abaxial view). Biii. Flower bud. C. Calyxine colleter. D. Faulcal annulus of the corolla, gynostegial corona, and style-head. E. Style-head and laminar dorsal anther appendages (top view). F. Detail of laminar dorsal anther appendage. G. Pollinarium. Based on *Sandwith 1840* (K). Ca = faulcal annulus of corolla; Ci = interstaminal gynostegial corona segment; Cd = laminar dorsal anther appendage; Co = corpusculum; Cs = staminal gynostegial corona segment; Po = pollinium; Sh = style-head.

2. *Gonolobus tobagensis* Urb., Repert. Spec. Nov. Regni Veg. 16:37. 1919. (**Fig. 2**). TYPE: TOBAGO: The Widow, a climbing plant, 28 Apr 1913, W.E. Broadway 4467 (LECTOTYPE, designated by Krings 2008b: BM!).

Herbaceous perennial vines. Latex unknown, presumably white. Stems pubescent, both short, capitate-glandular, and longer, sharp, eglandular trichomes present, the latter throughout, spreading, or retrorse internodally, and antrorse-appressed along an indistinct, horizontal ridge between two opposing petioles and/or just above the node, to 1.3 mm long; nodes pubescent, gland field apparently absent. Leaf blades ovate to oblong-ovate, 3–10.8 cm × 1–5.7 cm, apices gradually or abruptly acuminate with the acumen narrowly obtuse, 0.9–1.9 cm long, bases deeply cordate, margins entire, evenly pubescent on both surfaces, trichomes sharp, eglandular, glandular emergences from the surface apparently absent, colleters 2, ca. 0.9 mm long; petioles 1–4.5 cm long, spreading pubescent on all sides, some trichomes capitate, to 0.2 mm long, but mostly sharp, eglandular, to 1.4 mm long; stipular colleters 2, ca. 0.3 mm long, one borne on each side of the petiole base (rarely on the stem). Inflorescences racemiform, peduncles 0.2–4.7 cm long, capitate, as well as sharp, eglandular trichomes present, the latter mostly spreading to somewhat retrorse, distributed throughout, ca. 1.5 mm long; pedicels ca. 3.6 cm long, relatively evenly pubescent from apex to base, capitate-glandular trichomes ca. 0.16 mm long, longer, sharp, eglandular trichomes antrorsely-ascending, ca. 1.5 mm long, bracts linear to linear-oblong, 7.6–16 mm × 1.2–2.4 mm, persistent, adaxial surface glabrous, abaxial surface coarsely pubescent, trichomes sharp, eglandular, ca. 0.6 mm long, antrorse. Calyx lobes 5, linear-lanceolate, 8.5–13 mm × 1.7–2.6 mm, apices acute to narrowly obtuse, margins sparsely ciliate or glabrous, abaxial surface densely and coarsely pubescent at the base and variously toward the apex, trichomes antrorsely appressed or -ascending, to 0.8 mm long; colleters 1 per sinus. Corolla lobes 5, narrowly lanceolate to elongate triangular, 13.8–18.4 mm × 4.2–5.3 mm, slightly lobed at the base, a glandular swelling frequently present in the sinus, adaxial surface papillate-pubescent on the right half, abaxial surface pubescent with coarse, sharp, eglandular, antrorsely-appressed or -ascending trichomes, particularly at the base and variously toward the apex, ca. 0.38 mm long; faucal annulus (corolline corona or Ca) interrupted, a raised bump or indistinct ridge opposite each corolla lobe sinus, pubescent; gynostegial corona of fused staminal (Cs) and interstaminal (Ci) parts, prostrate-undulating, single, secondary nectaries in interstaminal position unknown (could not be determined from specimens); anther guiderails without appendages, laminar dorsal anther appendages (Cd) ca. 2.9 mm wide, truncate; style-head ca. 4.3 mm diam, stipe ca. 1 mm long, edentate. Pollinaria: corpuscula ca. 0.3 mm long, pollinia borne horizontally, narrowly ovate, ca. 1.3 mm × 0.29 mm. Follicles unknown.

Phenology. Flowering in April, October, and November.

Distribution.—*Gonolobus tobagensis* has been previously considered endemic to Tobago and Trinidad, but was recently cited from Guyana, though not the rest of the Guianan Shield (i.e., not in French Guiana, Surinam, Venezuela: Amazonas, Bolivar, Delta Amacuro; Morillo 2007). In light of the issues presented above, a re-evaluation of the application of this name to South American material is warranted. In Trinidad and Tobago, *G. tobagensis* is known from only four collections (including the type). Its habitat is unclear, but likely mid-elevation rainforests as for other West Indian congeners.

Etymology.—The specific epithet means “from Tobago.”

Taxon concept mapping.— = *G. tobagensis* sensu Cheesman (1947).

Additional specimens examined. **Tobago**: Arima (sp?)-Blanchisseuse Rd. 8th m., 6 Nov 1938, Cheesman 13357 (TRIN); Mount St. George-Castara Rd (sp?), in forest reserve of Main Ridge, 18 Oct 1937, N.Y. Sandwith 1840 (K). **Trinidad**: Quare River forests, above the reservoir, 1 Apr 1928, W.E. Broadway 6876 (MO).

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LITERATURE CITED

- CHEESMAN, E.E. 1947. Asclepiadaceae. In: E.E. Cheesman and R.O. Williams, eds. Flora of Trinidad and Tobago. Department of Agriculture, Port-of-Spain. Pp. 162–175.
- DECAISNE, J. 1844. *Gonolobae*. In: A.P. de Candolle, ed. Prodrromus Systematis Naturalis Regni Vegetabilis 8. Treuttel & Würtz, Paris. Pp. 591–605.
- FONTELLA P., J. SCHWARZ, AND E.A. SCHWARZ. 1981. Estudos em Asclepiadaceae, XIII. Novos sinônimos e novas combinações. Bol. Mus. Mun. Curitiba 46:1–10.
- FOURNIER, E.P.N. 1885. *Exolobus*. In: C.F.P. von Martius, ed. Flora Brasiliensis 6(4). F. Fleischer, Monaco. Pp. 318–319.
- FRANZ, N.M., R.K. PEET, AND A.S. WEAKLEY. 2008. On the use of taxonomic concepts in support of biodiversity research and taxonomy. New Taxonomy Proceedings of the 5th Biennial Meeting of the Systematics Association, Cardiff.
- GRISEBACH, A.H.R. 1864. Flora of the British West Indian Islands. Reeve & Co., London.
- HECHEM, V. AND C. EZCURRA. 2006. Asclepiadaceae. In: L.J. Novara, ed. Flora del Valle de Lerma. Serie Flora 7 (13). Facultad de Ciencias Naturales, Universidad Nacional de Salta, Salta. Pp. 1–64.
- HOLMGREN, P.K. AND N.H. HOLMGREN. 1998–present (continuously updated). Index Herbariorum. New York Botanical Garden. [<http://sciweb.nybg.org/science2/IndexHerbariorum.asp>]
- KRINGS, A. 2008a. Revision of *Gonolobus* s.s. (Apocynaceae, Asclepiadoideae) in the West Indies. J. Bot. Res. Inst. Texas 2:95–138.
- KRINGS, A. 2008b. Index of names and types in West Indian Gonolobinae (Apocynaceae, Asclepiadoideae), including fourteen new lectotypifications, one neotypification, and a new combination. J. Bot. Res. Inst. Texas 2:139–163.
- KRINGS, A., D.T. THOMAS, AND Q.-Y. XIANG. 2008. On the generic circumscription of *Gonolobus* (Apocynaceae: Asclepiadoideae): Evidence from molecules and morphology. Syst. Bot. 33:403–415.
- KUNZE, H. 1995. Floral morphology of some Gonolobeae (Asclepiadaceae). Bot. Jahrb. Syst. 117:211–238.
- LIEDE, S. AND H. KUNZE. 1993. A descriptive system for corona analysis in Asclepiadaceae and Periplocaceae. Pl. Syst. Evol. 185:275–284.
- LIEDE-SCHUMANN, S., A. RAPINI, D.J. GOYDER, AND M.W. CHASE. 2005. Phylogenetics of the New World subtribes of Asclepiadeae (Apocynaceae–Asclepiadoideae): Metastelmatinae, Oxypetalinae, and Gonolobinae. Syst. Bot. 30:184–195.
- MORELLATO, P.C. AND H.F. LEITÃO-FILHO. 1999. Reproductive phenology of climbers in a southeastern Brazilian forest. Biotropica 28:180–191.
- MORILLO, G. 2007. Asclepiadaceae. In: V. Funk, T. Hollowell, P. Berry, C. Kelloff, and S.N. Alexander, eds. Checklist of the plants of the Guiana Shield. Contr. US Natl. Herb. 55:208–212.
- RAPINI, A., M.W. CHASE, AND T.U.P. KONNO. 2006. Phylogenetics of South American Asclepiadoideae (Apocynaceae). Taxon 55:119–124.
- RAPINI, A., M.W. CHASE, D.J. GOYDER, AND J. GRIFFITHS. 2003. Asclepiadeae classification: evaluating the phylogenetic relationships of New World Asclepiadoideae (Apocynaceae). Taxon 52:33–50.
- SCHLECHTER, R. 1899. Asclepiadaceae. In: I. Urban, ed. Symbolae Antillanae. Gebrüder Borntraeger, Berlin. Pp. 236–290
- SCHLECHTER, R. 1912. Asclepiadaceae. In: I. Urban, ed. Symbolae Antillanae. Gebrüder Borntraeger, Berlin. Pp. 338–341.
- VAHL, M. 1798. Icones illustrationi plantarum Americanarum. Hauniae, Copenhagen.